Measurement of residual nuclueus cross sections and recoil energies in p + Fe

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The production of residual nuclei in p + Fe collisions has been measured at GSI on the FRS facility by mean of the reverse kinematic techniques at 300 MeV/A, 500 MeV/A, 750 MeV/A, 1 GeV/A and 1.5 GeV/A. A consistent set of cross sections for all isotopes produced above 0.01 mb is obtained and will be presented. The experiment gives also access to the momentum spectra of each isotope, so that properly transformed, the recoil energy of residues is experimentally known in the usual kinematics (proton on iron).

These data are interesting at several levels. Originally triggered by astrophysical considerations, they provide a detailed experimental knowledge of the spallation process around energies frequently found in cosmic radiations, and for elements of special importance in the nucleosynthesis and in the interstellar medium.

For hybrid systems, the proton beam accelerated under vacuum will have to cross a window before entering the spallation target and the subcritical reactor. Whether or not this window is considered as a safety barrier is a matter of debates heavily function of the window resistance. In most of the designs, this thin window is dominantly made of iron, so that the data obtained here are directly useful (with no transport corrections) to know the amount of impurities accumulated and the damage due to the recoil of residual nuclei.

As a test of spallation models, iron data complements the previous results obtained on heavy nucleus (U, Pb and Au) by a large step on the target mass. An effective beam energy dependence is also obtained for the first time in this type of experiments. The comparison with various combinations of intra-nuclear cascades and evaporations will be presented and discussed.

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